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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/292,186 04/15/99 KINZER

D IR-1609-(2-1

EXAMINER

002352 MM92/0126
OSTROLENK FABER GERB & SOFFEN
1180 AVENUE OF THE AMERICAS
NEW YORK NY 10036-8403

HU, SART UNIT	PAPER NUMBER
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2011
DATE MAILED:

01/26/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
09/292,186

Applicant(s)
Kinzer

Examiner
Shouxiang Hu

Group Art Unit
2811



☒ Responsive to communication(s) filed on Nov 17, 2000

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 35 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire three month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

☒ Claim(s) 1-13 and 16-22 is/are pending in the application

Of the above, claim(s) 16-19 is/are withdrawn from consideration

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-13 and 20-22 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☒ The proposed drawing correction, filed on Aug 15, 2000 is ☒ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been
☐ received.

☐ received in Application No. (Series Code/Serial Number) _____

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☒ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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DETAILED ACTION

Drawings

1. The proposed drawing correction, filed on August 15, 2000, has been found to be acceptable.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 9 is rejected as it recites the limitation "the other conductive type" (lines 2 and 3).

There is insufficient antecedent basis for this limitation in the claim.

Claims 1-3 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 recites a "channel of one of the conductivity types disposed between a source region and a drain region" (claim 1, lines 2 and 3), but it is not clear whether it is referring to the conductivity type of the channel itself in its on state or to the conductivity type of the channel forming doped layer.

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Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

Claims 1, 4 and 5 are rejected under 35 U.S.C. 102(e) as being anticipated by Floyd et al. (6,069,043).

Floyd et al. disclose a trench-type power MOSFET (Fig. 1), comprising: a plurality of vertical invertible channels in a p-type epitaxially deposited channel forming layer (24) between heavily doped n-type source regions (22) and heavily doped n-type drain regions (26); gate oxide walls (12), n-type polysilicon trench gates (10, see col. 1, lines 24-40); and, source contacts (32) in contact with the source regions.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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Claims 2, 3, 6-13 and 20-22 are rejected under 35 U.S.C. 103(a) as being obvious over Floyd et al. (6,069,043).

The disclosure of Floyd et al. is discussed as applied to claims 1, 4 and 5 above.

Regarding claims 2, 7 and 9-13, it is noted that the MOSFET shown in Fig. 1 of Floyd et al. is an n-p-n polarity type; and that it is well known in the art that a MOSFET design which works under one polarity type is normally also workable under the reversed polarity. Therefore, it would have been well within the ordinary skilled in the art at the time the invention was made to make the semiconductor device of Floyd et al. with the polarity being reversed, so that improved design flexibility would be achieved.

Regarding claim 3, it is noted that Si is the most widely used semiconductor material.

Regarding claims 8, 11-13, although Floyd et al. do not expressly disclose that the channel layer can have a resistivity of about 0.17 Ohm-cm and a thickness of about 2.5 um, and that the substrate has a resistivity less than 0.0005 Ohm-cm, it noted that it is old and well known in the art the threshold voltage and the on-resistance of MOSFET are directly correlated to the doping concentrations of the channel layer and the substrate layer; and they are the well recognized parameters of importance subject to routine experimentation and optimization.

Therefore, it would have been obvious to one of ordinary skilled in the art at the time the invention was made to make the semiconductor device of Floyd et al. with the channel layer having a resistivity of about 0.17 Ohm-cm and a thickness of about 0.25 um and the substrate

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having a resistivity less than 0.0005 Ohm-cm, so that the desired threshold voltage and the on-resistance of the MOSFET would be achieved.

Regarding claims 6 and 20-21, it is noted that it is well known in the art that it is desirable to have a source electrode in direct contact with both of the heavily doped source region and the channel-forming base region through a heavily doped base region for improving the device stability (as evidenced in the prior art, such as in Fig. 12 of Floyd et al.).

Response to Arguments

5. Applicant's arguments filed on August 15, 2000, have been fully considered but they are not persuasive.

With respect to Applicant's main arguments including that the applied prior art reference fails to teach to form the trench gate with a conductivity type opposite to the one in the channel forming base layer, the response has been incorporated into the above rejections.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

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the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 or 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to *Shouxiang Hu* whose telephone number is (703) 306-5729. The Examiner is in the Office generally between the hours of 8:00AM to 5:30PM (Eastern Standard Time) Tuesday through Friday.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is (703) 308-0956.

Shouxiang Hu

January 24, 2001

Tom Thomas